

CLAIMS

What is claimed is:

1. A method of stacking a first integrated circuit die and a second integrated circuit die on a base having a surface comprising:
 - forming a plurality of flip-chip pads on a surface of said substrate;
 - forming a plurality of wire bond pads on a surface of said substrate;
 - connecting at least one pad of the flip-chip pads to at least one pad of the wire bond pads;
 - providing a first integrated circuit die having a front-side surface having a plurality of flip-chip bumps thereon and having a back-side surface;
 - positioning the front-side surface of the first integrated circuit die facing the surface of the base;
 - aligning at least one flip-chip bump of the plurality of flip-chip bumps on the front-side surface of the first integrated circuit die with at least one pad of the flip-chip pads on the surface of the base;
 - connecting the at least one flip-chip bump of the plurality of flip-chip bumps on the front-side surface of the first integrated circuit die to the at least one pad of the flip-chip pads on the surface of the base;
 - providing a second integrated circuit die having a front-side surface having a plurality of bond pads thereon and having a back-side surface;
 - positioning the back-side surface of the second integrated circuit die facing the back-side surface of the first integrated circuit die;
 - attaching the back-side surface of the second integrated circuit die to the back-side surface of the first integrated circuit die;
 - connecting at least one bond pad of the plurality of bond pads on the front-side surface of the second integrated circuit die to at least one pad of the wire bond pads on the surface of the base; and
 - sealing between at least a portion of the front-side surface of the first integrated circuit die and the surface of the base.

2. The method of claim 1, further comprising:
sealing completely between the front-side surface of the first integrated circuit die and the surface of the base.
3. The method of claim 2, wherein the step of sealing between at least a portion the front-side surface of the first integrated circuit die and the surface of the base comprises underfilling therebetween.
4. The method of claim 1, further comprising:
sealing the first integrated circuit die and the second integrated circuit die.
5. The method of claim 4, wherein the step of sealing the first integrated circuit die and the second integrated circuit die comprises:
encapsulating the first integrated circuit die and the second integrated circuit die.
6. The method of claim 1, wherein the first plurality of pads on the base and the second plurality of pads on the base are provided by one of screen printing and selectively plating the flip-chip pads and the wire bond pads on the surface of the base.
7. The method of claim 1, wherein the positioning the first integrated circuit die and positioning the second integrated circuit die comprise:
picking and placing the first integrated circuit die and the second integrated circuit die.
8. The method of claim 1, wherein the connecting the at least one flip-chip bump of the plurality of flip-chip bumps on the first integrated circuit die to the at least one pad of the flip-chip pads on the base comprises:
reflow-soldering the at least one flip-chip bump of the plurality of flip-chip bumps on the first integrated circuit die to the at least one pad of the flip-chip pads on the base.

9. The method of claim 1, further comprising:
testing the connection of the at least one flip-chip bump of the plurality of flip-chip bumps on the first integrated circuit die to the at least one pad of the flip-chip pads on the base;
determining if the connection is defective; and
repairing the connection when defective.

10. The method of claim 1, wherein the attaching the back-side surface of the second integrated circuit die to the back-side surface of the first integrated circuit die comprises:
attaching the back-side surface of the first integrated circuit die to the back-side surface of the second integrated circuit die using an uncured epoxy; and
curing the uncured epoxy.

11. The method of claim 1, wherein the connecting the at least one bond pad of the plurality of bond pads on the second integrated circuit die to the at least one pad of the second plurality of pads on the base comprises:
wire-bonding the at least one bond pad of the wire bond pads on the second integrated circuit die to the at least one pad of the second plurality of pads on the base.

12. The method of claim 1, further comprising:
testing the connection of the at least one bond pad of the plurality of bond pads on the second integrated circuit die to the at least one pad of the wire bond pads on the base;
determining if the connection is defective; and
repairing the connection when defective.

13. A method of repairing a flip-chip die connected to a surface of a base having flip-chip pads and wire bond pads on a surface thereof, the flip-chip die having a front-side surface and back-side surface, the front-side surface having at least one flip-chip bump of a plurality of flip-chip bumps thereon bonded to at least one pad of the flip-chip pads on the surface of the base, at least one pad of the flip-chip pads and at least one pad of the wire bond pads on the surface of the base each connected to at least one conductor of a plurality of conductors for communication between the flip-chip die and circuitry external to the flip-chip die, said method comprising:

attaching a replacement integrated circuit die having a front-side surface and back-side surface to the back-side surface of the flip-chip die, the front-side surface of the replacement integrated circuit die having a plurality of bond pads thereon;
stopping communication between the flip-chip die and said external circuitry connected thereto by disconnecting at least one of the flip-chip pads on the surface of the base from the at least one of the plurality of conductors at locations proximal to the flip-chip pads;
electrically connecting at least one bond pad of the plurality of bond pads on the front-side surface of the replacement integrated circuit die to at least one pad of the wire bond pads on the surface of the base for communication between the replacement integrated circuit die and circuitry external to the replacement integrated circuit die.

14. The method of claim 13, wherein the second plurality of pads on the surface of the base includes at least one pad of the wire bond pads on the surface of the base is connected to the at least one pad of the flip-chip pads of the base.

15. The method of claim 13, wherein stopping communication between the flip-chip die and the external circuitry comprises:
disconnecting each pad of the flip-chip pads on the surface of the base from the plurality of conductors at locations proximal to the flip chip pads.

16. A method of assembling a multi-chip structure on a base having a surface comprising:
forming flip-chip pads on the surface of the base;
forming wire bond pads on the surface of the base;
interconnecting at least one pad of the wire bond pads and at least one pad of the flip-chip pads;
positioning a first integrated circuit die having a front-side surface having a plurality of flip-chip bumps thereon and having a back-side surface, the front-side surface of the first integrated circuit die facing the surface of the base, at least one flip-chip bump of the plurality of flip-chip bumps on the front-side surface aligned with at least one pad of the flip-chip pads on the surface of the base;
connecting the at least one flip-chip bump of the plurality of flip-chip bumps on the front-side surface of the first integrated circuit die to the at least one pad of the flip-chip pads on the surface of the base;
positioning a second integrated circuit die having a front-side surface having a plurality of bond pads thereon and having a back-side surface, the back-side surface of the second integrated circuit die facing the back-side surface of the first integrated circuit die;
attaching the back-side surface of the second integrated circuit die to the back-side surface of the first integrated circuit die;
connecting at least one bond pad of the plurality of bond pads on the front-side surface of the second integrated circuit die to at least one of the wire bond pads on the surface of the base; and
sealing at least a portion of the gap between the front-side surface of the first integrated circuit die and the surface of the base.

17. The method of claim 16, further comprising:
sealing the entire gap between the front-side surface of the first integrated circuit die and the surface of the base.

18. The method of claim 16, further comprising:
sealing the first integrated circuit die and the second integrated circuit die.
19. The method of claim 18, wherein the sealing the first integrated circuit die and the second integrated circuit die comprises:
encapsulating the first integrated circuit die and the second integrated circuit die.
20. The method of claim 16, wherein forming the flip-chip pads and forming the wire bond pads comprise one of screen printing and selectively plating the flip-chip pads and the wire bond pads on the surface of the base.
21. The method of claim 16, wherein connecting the at least one flip-chip bump of the plurality of flip-chip bumps on the first integrated circuit die to the at least one pad of the flip-chip pads on the base comprises reflow-soldering the at least one flip-chip bump of the plurality of flip-chip bumps on the first integrated circuit die to the at least one pad of the flip-chip pads on the base.
22. The method of claim 16, further comprising:
testing the connection of the at least one flip-chip bump of the plurality of flip-chip bumps on the first integrated circuit die to the at least one pad of the flip-chip pads on the base;
determining if the connection is defective; and
repairing the connection when the connection is defective.
23. The method of claim 16, wherein the step of connecting the at least one bond pad of the plurality of bond pads on the second integrated circuit die to the at least one pad of the second plurality of pads on the base comprises:
wire-bonding the at least one bond pad of the plurality of bond pads on the second integrated circuit die to the at least one pad of the wire bond pads on the base.

24. A method of repairing a flip-chip die connected to a surface of a die-carrying base, said method comprising:

- providing a flip-chip die having a front-side surface and a back-side surface, the front-side surface having flip-chip bumps thereon;
- providing a base having a surface having flip-chip pads thereon, the flip-chip pads connected to a plurality of conductors for communication between the flip-chip die and circuitry external to the flip-chip die;
- bonding the front-side surface having flip-chip bumps thereon of the flip-chip die to the flip-chip pads on the surface of the base;
- forming wire bond pads on the surface of the base, at least one pad of the wire bond pads connected to at least one conductor of the plurality of conductors;
- bonding a replacement integrated circuit die having an opposing front-side surface having a plurality of bond pads thereon and back-side surface to the back-side surface of the flip-chip die;
- interrupting communication between the flip-chip die and the external circuitry by disconnecting at least one pad of the flip-chip pads on the surface of the base from at least one conductor of the plurality of conductors by cutting the at least one conductor of the plurality of conductors adjacent the at least one pad of the first plurality of pads; and
- bonding at least one bond pad of the plurality of bond pads on the front-side surface of the replacement integrated circuit die to the at least one pad of the wire bond pads on the surface of the base for communication between the replacement integrated circuit die and the external circuitry.

25. The method of claim 24, wherein forming the wire bond pads includes connecting at least one pad of the second plurality of pads with at least one pad of the first plurality of pads.

26. The method of claim 25, wherein interrupting communication between the flip-chip die and the external circuitry comprises:
disconnecting each pad of the flip-chip pads on the surface of the base from each conductor of the plurality of conductors by cutting the at least one conductor of the plurality of conductors adjacent the at least one pad of the flip-chip pads.

27. A method of making a base having a flip-chip pads on a surface thereof, at least one pad of the flip-chip pads connected to at least one flip-chip bump of a plurality of flip-chip bumps on a first die to be located on the surface of the base, the base used to carry a plurality of integrated circuit dice, the method comprising:
forming wire bond pads on the surface of the base;
connecting each bond pad of a plurality of bond pads on a second die to be located on the first die; and
interconnecting a plurality of pads of the wire bond pads on the base and a plurality of pads of the flip-chip pads on the base.